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NOTES ON GEOGRAPHIC DISTRIBUTION

First report of the invasive *Indotyphlops braminus* (Daudin, 1803), Flowerpot Blindsnake (Serpentes, Typhlopidae), in Ecuador

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Abstract. *Indotyphlops braminus* (Daudin, 1803), a fossorial snake of the family Typhlopidae, is reported for the first time in Guayas Province, Ecuador. These new records extend this species' distribution to South America. Native to southern India and Sri Lanka, *I. braminus* has spread worldwide through unintentional transport with ornamental plants. As one of the smallest snakes, it reproduces via triploid parthenogenesis and thrives in diverse habitats. Its accidental introduction may pose risks to local biodiversity. Monitoring and management efforts are required to control its spread and mitigate ecological impacts.

Key words. Biodiversity, exotic species, fossorial, parthenogenesis

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INTRODUCTION

Indotyphlops braminus (Daudin, 1803) belongs to the Typhlopidae family and is native to southern India and Sri Lanka (Wallach 2020). It is an invasive snake that has experienced global expansion, primarily facilitated by human activities, especially via unintentional transport among the roots of ornamental or edible plants (Crombie and Pregill 1999). In most places where this snake is introduced, it is the smallest documented snake (Wallach 2020, 2021).

Indotyphlops braminus is a tiny, strictly fossorial snake which is often mistaken for an earthworm (Wallach 2009; Hedges et al. 2014). Its small size, underground habits, and parthenogenetic reproduction have made this species a highly successful colonizer, capable of establishing a population even from a single individual. It is currently considered the terrestrial snake with the widest distribution in the world (Joger et al. 2008; Wallach 2009; Hedges et al. 2014; Booth and Schuett 2015; Rato et al. 2014; Zamora-Camacho 2017; Leets-Rodríguez et al. 2019).

Molecular data available for two similar species, *Indotyphlops pammeces* (Günther, 1864) and *I. albiceps* (Boulenger, 1898), show that these taxa are sister taxa in all phylogenetic analyses. *Indotyphlops braminus* is related to the *I. pammeces* species group *I. lankaensis* (Taylor, 1947), *I. malcolmi* (Taylor, 1947), *I. pammeces*, *I. tenebrarum* (Taylor, 1947), *I. veddae* (Taylor, 1947), and *I. violaceus* (Taylor, 1947), all of which inhabit Sri Lanka, except for *I. pammeces*, which is found in southern India. (Wallach 2021). Among these, *I. pammeces* shares with *I. braminus* features such as a tiny body size, 20 rows of scales with no reduction, the union of the supranasal suture with the narrow rostral dorsal suture, and, in some species, the contact between the infranasal suture and the preocular scale. Except for *I. pammeces*, species in the *pammeces* group are endemic to Sri Lanka, although their distribution includes wide tropical and subtropical areas.

Wallach (2021) presented a compilation of localities to track the global dispersion of *I. braminus*, highlighting its recent establishment in South America with the first confirmed record in Cerrito-Sazagua, Antioquia, Colombia.

Furthermore, he mentioned possible records on platforms like iNaturalist for Brazil and Ecuador (Wallach, 2021), although these remain unconfirmed. Specifically, a record from Chone, Manabí [iNaturalist observation iN69565680], initially identified as *Indotyphlops braminus*, turned out to be a mistake upon verification and was confirmed as *Epictia subcrotilla* (Klauber, 1939). During the course of this research, records in iNaturalist for the Guayas province were validated, establishing the first confirmed reports of *I. braminus* in Ecuador. The oldest record of *I. braminus* in the Guayas province dates back to 2016 [iN2575602]. The present study detected the species in december 2022 (Pérez and Zavala personal observation), although its

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correct identification was made one year later, with the discovery of the first five specimens in the locality of Capeira.

METHODS

The field research was conducted in the province of Guayas, Ecuador, in remnants of forests, as well as in urban parks and gardens. Specimen sampling was carried out through active searching and manual sampling in soft substrates, leaf litter, disturbed soils, and areas with high humidity, especially after rainfall events. Each sampling session lasted between 3 and 5 hours, depending on the environmental conditions of the site. The samplings were made during the day (10:00–15:00 h) and repeated on multiple visits at the end of the dry season, a period when the surface activity of the species increases. These observations were based on our own fieldwork and data collected during the study. The collected specimens were handled following standardized protocols for herpetological fauna, ensuring the morphological integrity of the specimens for subsequent analysis. For the identification and characterization of the specimens of *Indotyphlops braminus*, the methods and taxonomic descriptions of Wallach (2020) were used. Identification included measuring external morphometric characters, such as total length, tail length, and the number of dorsal and subcaudal scales. A morphological comparison with species of similar appearance, especially those endemic to the region, was also made (Figure 1). To avoid errors in identification, the type material of *Trilepida guayaquilensis* (Orejas-Miranda and Peters, 1970), documented by Koch et al. (2021), was examined. Additionally, due to the rarity of *Liotyphlops petersii* (Boulenger, 1889), photographic material was requested from curator Patrick Campbell of the Natural History Museum, London (NHMUK). The review included detailed comparisons of characteristics such as cephalic and body scalation, the configuration of cloacal and subcaudal scales, as well as the differentiation of patterns and body size. An exhaustive review of available museum collections and photographic material provided by collaborators was conducted. Additionally, public databases, including iNaturalist (2024) and occurrence data from the Global Biodiversity Information Facility (GBIF 2025) (Figure 2), were consulted to obtain further records of *I. braminus* and to identify potential taxonomic misidentifications.

RESULTS

***Indotyphlops braminus* (Daudin, 1803)**
Figures 1A, 3, 4A–F

New records. ECUADOR — **Guayas** • Capeira; –02.0094, –079.9674; 30.XII.2023; Zavala Eduardo obs.; photograph • ibid.; 17.XI.2024; Dávila Paul obs.; photograph • ibid.; 07.I.2025; Ramón Andrea obs.; photograph • Cdla. Bellavista; –02.1856, –079.9113; 09.XI.2022; Marcillo Edwin photograph • ESPOL-Campus Gustavo Galindo Velasco; –02.1467, –079.9633; 20.XI.2024; Muñoz Karen obs.; photograph • Guayacanes-Guayaquil; –02.1142, –079.8904; XII.2022; Pérez Jhenzio obs.; photograph • Parque Clemente Yerovi-Guayaquil; –2.1748,

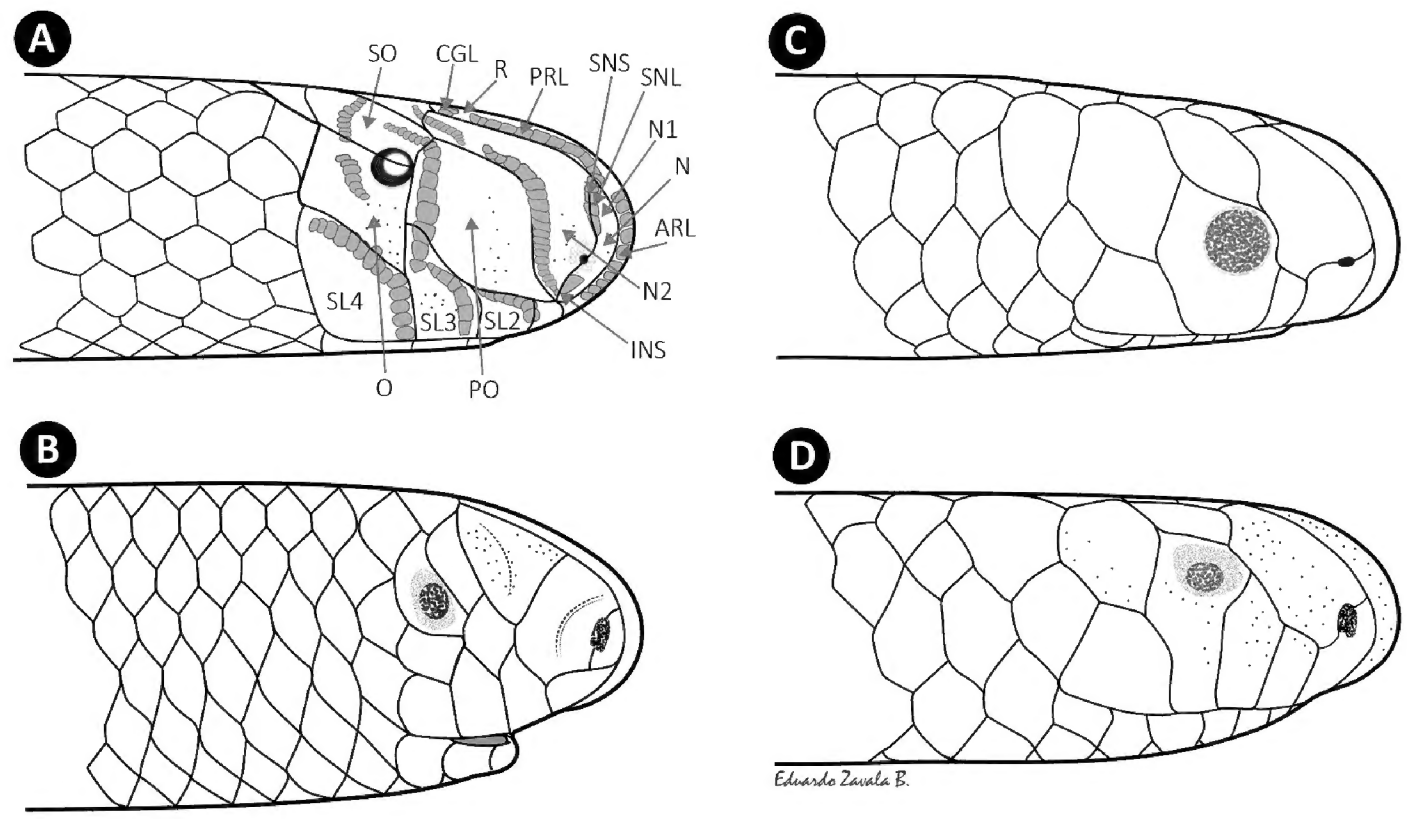

Figure 1. Arrangement and shape of cephalic scales in various blind-snake species in Guayas province, Ecuador. **A.** *Indotyphlops braminus*, based on live specimens from Capeira, Guayas province, Ecuador. **B.** *Liotyphlops petersii*, illustration based on the holotype NHMUK 1946.1.11.26. **C.** *Epictia subcrotilla*, illustration based on specimen QCAZ 12769 from Guayaquil, Guayas province, Ecuador. **D.** *Trilepida guayaquilensis*, illustration based on the holotype ZMB 4508. Abbreviations: ARL = Anterior rostral gland line; CGL = Curved gland line; INS = Inferior or infranasal suture; N = Nasal scale; N1 = Anterior or prenasal scale; N2 = Posterior or postnasal scale; O = Ocular scale; PO = Preocular scale; PRL = Posterior rostral gland line; R = Rostral scale; SL = Supralabial scale; SNL = Supranasal gland; SNS = Supranasal suture; SO = Supraocular scale.

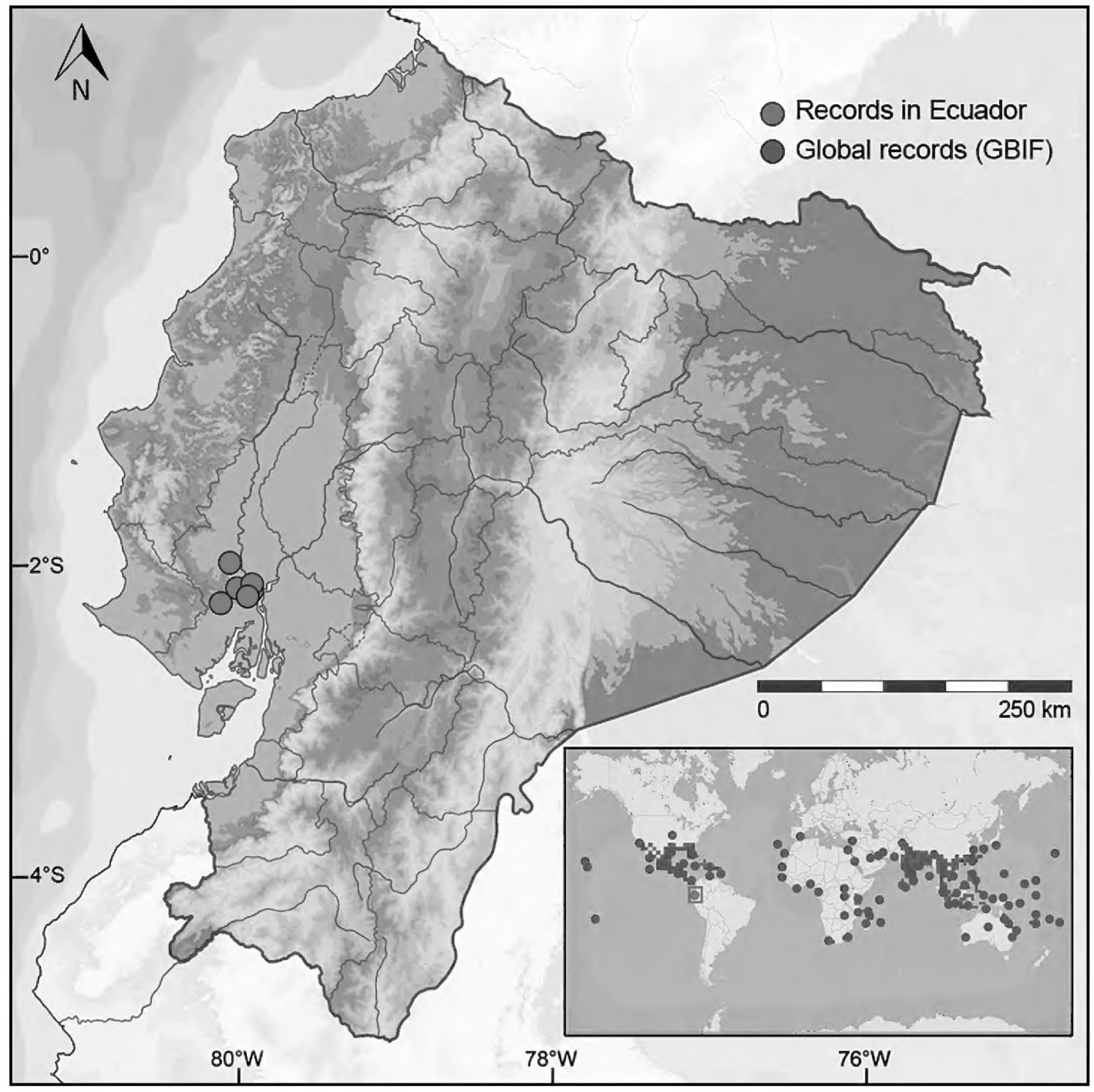

Figure 2. Distribution of *Indotyphlops braminus* in Ecuador. Green circles = previous records (source: GBIF); red circle = new records.

Figure 3. Adult individual of *Indotyphlops braminus* from Capeira, Guayas province, Ecuador.

—079.8986; 15.III.2024; Alava Leonardo obs.; https://www.inaturalist.org/observations/207874636 • Parque de la Virgen-Guayaquil; —02.1307, —079.8850; 21.VII.2022; Saá Rodriguez Joshua obs.; https://www.inaturalist.org/observations/128559490 • Parque Lineal Kennedy Norte-Guayaquil; —2.1612, —079.9017; 03.XII.2024; Delgado Jaime obs.; https://www.inaturalist.org/observations/254349790 • Samanes III-Guayaquil; —02.1169, —079.9039; 02.I.2024; Unknown obs.; https://www.inaturalist.org/observations/195597505 • Vía a la Costa, Km 24; —02.2127, —080.0863; 30.XII.2020; Pazmiño Emilio obs.; photograph • Unidad Educativa Nuevo

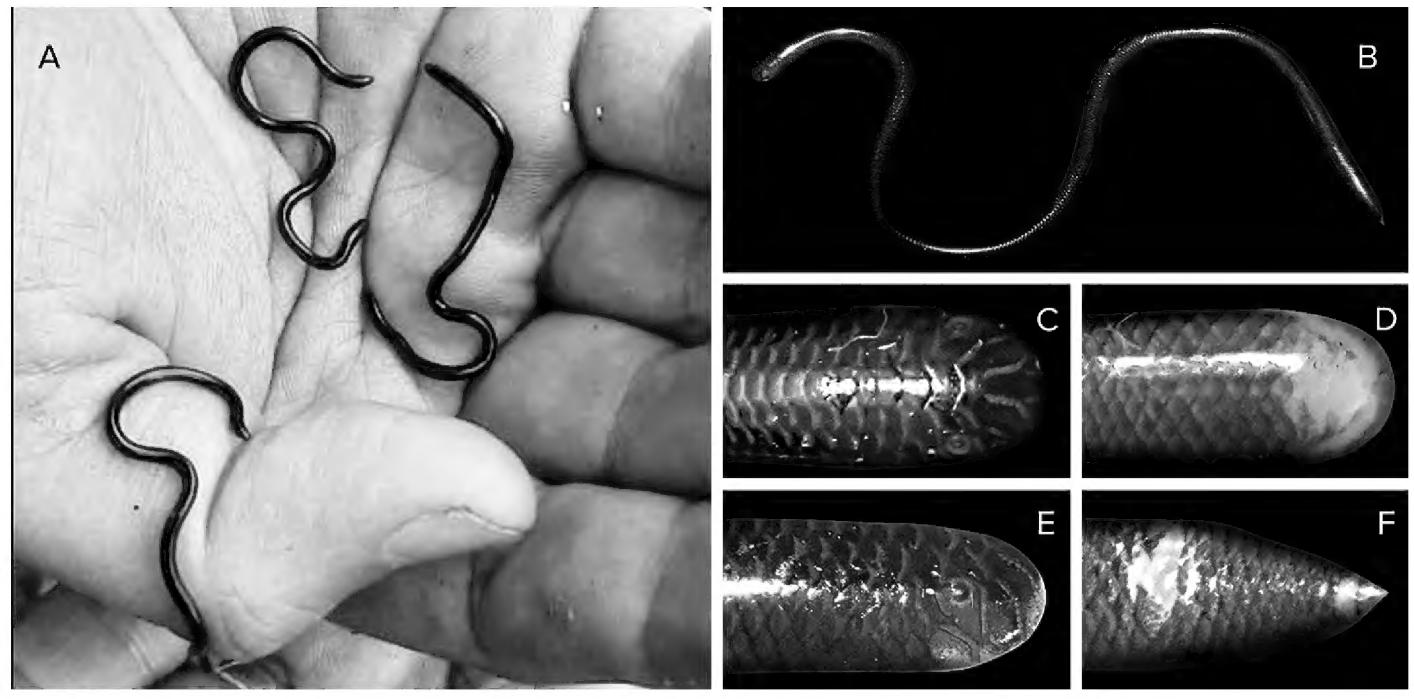

Figure 4. Individuals of *Indotyphlops braminus* from Capeira, Guayas province, Ecuador. **A.** Three living individuals on a researcher's hand to show size. **B–F.** Detailed views of a specimen: (**B**) aspect of body of an uncollected specimen; (**C**) dorsal view of the head; (**D**) ventral view of head; (**E**) lateral view; (**F**) ventral view of tail.

Mundo-Samborondón; −02.1324, −079.8653; 11.II.2020; Pérez Correa Julián obs.; https://www.inaturalist.org/observations/38539523 • Urb. Bouganville-Samborondón; −02.1309, −079.8663; 09.I.2016; Camacho Jaime obs.; https://www.inaturalist.org/observations/2575602.

Identification. Females of *I. braminus* range from 4.3 to 20.3 cm in total length (Wallach 2009, 2020). This small snake measures only 4–6.5 cm at birth, with the thickness of a pencil lead (1–2 mm) and a weight of just 0.1–0.2 grams. Adults typically measure between 10 and 13 cm in length, 3–4 mm in diameter, and weigh less than 1 g (Wallach 2020). Unconfirmed reports indicating a maximum length of 22–23 cm (Chaudhari 1986; Cox et al. 1998; Goris and Maeda 2004; Whitaker and Captain 2004; O'Shea 2007) likely stemmed from a misidentification by Smedley (1931) of a 23 cm long *I. albiceps* (Boulenger, 1898) mistakenly reported as *I. braminus*. Unfortunately, these specimens were not examined to confirm their identification by Van Wallach (2009).

Indotyphlops braminus is an exotic species that can be reliably identified in regions where no other scolecophid (Scolecophidia) or typhlopid (Typhlopidae) species are found (Wallach 2020). It is distinguished from other members of the Typhlopidae family by the following characteristics:

1. The infranasal suture (INS) curves downward from the nasal fossa (N) and contacts the preocular scale (PO), unlike other typhlopid species, where the INS typically contacts the first or second supralabial (SL1 or SL2). The supranasal suture (SNS) extends upward and backward across the snout, contacting the rostral scale (R), which completely divides the nasal scale. This condition is unique, as in most typhlopids the SNS does not contact the rostral and does not extend across the snout dorsally (Wallach 2020).
2. The head of *I. braminus* features prominent and distinctive subcutaneous sebaceous glands arranged in rows beneath each head scale (also present in the species group *I. pammeces*). These glandular lines run parallel and along the margins of the anterior head scales (Wallach 2020).
3. The coloration of *I. braminus* ranges from jet black to shades of brown, tan, and pink. However, it has distinctive coloration features such as a lighter snout, a white chin, a white cloacal region, and a white tail tip.
4. It is the only known snake species with obligate unisexual parthenogenetic reproduction (Wynn et al. 1987; Wallach 2009, 2020).

Specimens from Guayaquil. Specimens of *I. braminus* from Guayaquil typically do not exceed 6.9 cm in total length, making them considerably smaller compared to other closely related native species. In contrast, *Trilepida guayaquilensis* reaches a total length of approximately 17 cm (Orejas-Miranda and Peters 1970), *Epictia subcrotilla* can grow up to 18.8 cm (Klauber 1939), and *Liotyphlops petersii* averages around 11 cm (Boulenger 1889).

The head is slightly wider than the anterior portion of the body and is convex dorsally. The snout is elliptical in lateral view and subrectangular when viewed from above and below. The rostral scale is narrow and longer than wide in dorsal view, extending only slightly past the anterior level of the eye. The snout tip is broadly rounded in dorsal view. The frontal scale extends to the upper level of the eye. The first glandular line runs straight along the head but does not reach the eyes, while the second glandular line is convex, with its midpoint at the eye level. The nostrils are smaller than the eyes and are adjacent to nasal sutures. The nasal scale is fully divided, and the postnasal scale does not extend to the anterior level of the eye. The eyes are small and visible, with a horizontally elliptical pupil. There are four supralabials, with their size increasing from the first to the last. The body features 20 longitudinal rows of scales, approximately 333 mid-dorsal scale rows, and 13 subcaudal scales. The tail tapers slightly in the first three-quarters of its length posterior to the cloaca, then narrows more abruptly toward the tip. The terminal scale is cone-shaped, ending in a pointed keratinized spine.

The coloration in life is characterized by a uniformly dark brown dorsal surface, with all dorsal scales showing darker basal pigmentation. The head is slightly paler, with a pinkish-brown hue, white glandular margins, and a whitish chin. The ventral region is lighter overall, with darker pigmentation along the scale margins, creating a checkered pattern. Scales around the cloacal region and those in contact with the keratinized tail tip are distinctly white.

The specimens exhibited three defensive behaviors: an attempt to flee, the use of the modified caudal scale to "sting," and the release of musk.

Distribution. *Indotyphlops braminus* is native to Southeast Asia and it is considered the most successful terrestrial snake in terms of global dispersion, with the most likely mechanism of dispersal being involuntary transport in the root balls of ornamental or food plants carried by humans (Crombie and Pregill 1999). It has a global distribution, being limited to fewer than 40 countries in the 19th century (1803–1900). However, in the 20th century, this number doubled, reaching 81 countries (Wallach 2020). Subsequently, Wallach (2021) updated the distribution to 122 territories, including both countries and insular dependencies as well as territories.

Ecology. *Indotyphlops braminus* exhibits nocturnal and fossorial habits, which makes encounters rare, especially by chance or through incidental observations. Daytime surface records typically follow heavy rains, with the species ascending to ground level when its underground air supply is interrupted (Wallach 2020). It can be found while gardening, raking leaves, digging soil, or beneath stones. This species feeds exclusively on ants and termites, particularly their eggs, nymphs, pupae, and larvae (Wallach 2020). Although it may resemble an earthworm at first glance, its true identity is revealed upon closer inspection, as it is covered with hard, shiny scales, lacks segmentation, has a forked tongue, and a pair of dark eye spots. It moves quickly like a snake on smooth surfaces and disappears rapidly into loose soil (Wallach 2020). When exposed, *I. braminus* attempts to anchor itself to the soil and move violently. It may press the tip of its tail against the captor's skin, delivering a sharp but harmless prick. Additionally, it has the ability to release a strong musk through the cloaca, similar to that produced by colubrid snakes. This species lays an average of 3 eggs (range: 1–8) throughout the year in tropical regions, with at least three clutches annually in the Seychelles Archipelago. In colder climates or at higher elevations, it lays eggs only once a year or every two years (Wallach 2020). It is parthenogenetic, reproducing without mating. Parthenogenesis in *I. braminus* is particularly remarkable due to its triploid condition, where the resulting individual has three sets of chromosomes, instead of the typical two in diploid species. This form of reproduction arises from an unfertilized egg that replicates or duplicates its genetic material. This enables reproduction in environments where mates are scarce. McDowell (1974) first suggested this after examining 114 specimens, mostly from Asian and Indonesian origins, and finding no males. Further research by Wynn et al. (1987) and Ota et al. (1991) confirmed the species' triploid parthenogenetic nature. *Indotyphlops braminus* is found in human dwellings, gardens, loose soil, garbage piles, decomposing logs and trees, gutters, drainage ditches, under leaf litter, piles of stones, stacked bricks, and flower pots. It naturally occurs in various habitats, from coastal dunes to tropical forests, particularly in disturbed areas and secondary growth, with a preference for moist soils (Broadley and Wallach 2009). Wallach (2020) notes that specimens found in houses and their surroundings are generally juveniles, indicating that adults are already present and reproducing. This species is likely present in numerous undocumented areas.

Additional notes. In Guayaquil, *I. braminus* has been recorded in urban and disturbed areas, especially in gardens with ornamental shrubs such as *Ixora chinensis* Lam. and palms of the genus *Roystonea* O.F.Cook. These snakes are also common in urban parks with extensive tree canopies, such as the saman *Samanea saman* (Jacq.) Merr. In peri-urban areas, they have been observed at the base of tall grasses, such as *Megathyrsus* sp., and in gardens. Their presence in these gardens may be linked to their spread from local nurseries, often found near shallow ant nests with egg galleries. It is important to note that the only species in Ecuador with similar glandular lines is *Amerotyphlops reticulatus* (Linnaeus, 1758), the sole confirmed representative of the family Typhlopidae in the country. In this context, the analysis of specimen QCAZR 3855, collected at Hacienda Molinitos, La Tola Road, Esmeraldas, which had been incorrectly identified as *Liotyphlops albirostris* (Peters, 1858), revealed characteristics consistent with *Amerotyphlops reticulatus*, including the glandular lines on the head.

DISCUSSION

This study provides the first report of *Indotyphlops braminus* for Ecuador and specifically from Guayas province. This finding expands the known geographic range of the species, which was previously documented primarily in Southeast Asia, with scattered instances of introduced localities throughout tropical regions, such as the Caribbean and Central America. The Ecuador records not only extend the species' distribution but also confirm its ability to colonize new urban and peri-urban habitats. The presence of *I. braminus* highlights its status as a synanthropic invasive species, with its success in disturbed environments potentially linked to its parthenogenetic reproduction. This reproductive strategy enables a single individual to estab-

lish viable populations in new areas, which combined with its diet composed of small soil invertebrates, could disrupt local trophic dynamics.

In contrast, the potential coexistence of *I. braminus* with endemic species such as *Trilepida guayaquilensis* and *Liotyphlops petersii*, could present significant conservation challenges. If *I. braminus* competes directly for resources or acts as a vector for introduced pathogens, it may negatively impact these threatened native species. Further studies are needed to assess the ecological impact of *I. braminus* on native communities and to develop effective conservation strategies.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: EZ, AA. Data curation: AA. Formal analysis: AA, EZ. Funding acquisition: AA. Investigation: EZ, AA. Methodology: AA. Writing – original draft: EZ, AA. Writing – review and editing: EZ, AA.

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Data availability

All data that support the findings of this study are available in the main text.

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